OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **LITTLE LAKE SUNAPEE** the program coordinators recommend the following actions. *We would like to encourage the association to conduct more sampling events in the future. With a limited amount of data it is difficult to determine water quality trends. Since weather patterns and activity in the watershed can change throughout the summer it is a good idea to sample the lake at least once a month during the season.*

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show chlorophyll-a concentrations have *decreased* since 1996. The chlorophyll-a concentration remained well below the state mean. While algae are present in all lakes, an excess amount of any type is not welcomed. Algal concentrations can increase when there are external and internal sources of phosphorus. Phosphorus is the nutrient that algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows in-lake transparency has *decreased* since 1996. However, the transparency was still above the New Hampshire mean. There was only one reading in June, a month that is typically high from the spring diatom increase. The 2000 sampling season was considered wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity. Efforts should be made to stabilize stream banks, lake shorelines, and disturbed soils in the watershed. Guides to Best Management Practices are available from NHDES upon request.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show epilimnetic phosphorus levels were *higher* this year than in 1996, while hypolimnetic concentration *decreased* in the same time period. Both layers had concentrations below the state median. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- We would like to suggest that the association consider conducting more deep spot sampling in place of the nearshore samples that have been collected in the past. We understand the nearshore samples have been collected for nearly 20 years and applaud your efforts. Sampling each thermal layer in the deepest point of the lake, however, may give us a better understanding of the overall health of the lake. The VLAP Coordinator would like to visit the lake in the summer of 2001 to meet with the volunteer monitors, conduct a dissolved oxygen profile, and collect a plankton sample. The Program does not have any records of the planktonic populations or the concentration of dissolved oxygen. We generally use these factors to help determine the quality of lakes in New Hampshire. Please contact the VLAP Coordinator this spring at (603) 271-2658 to schedule a visit.

- The VLAP files do not have any records of where the nearshore stations are located or whether the sites' letters are being assigned consistently. Please indicate on the map in Appendix C where samples are collected and return the map to us so we can make the appropriate changes in our files.

- Many of the nearshore stations experienced lower conductivity values this year than in the past (Table 6). However, the epilimnion, metalimnion, and hypolimnion all had increased conductivities this year. Fortunately, the levels are not excessive and should not be of great concern the association. If the levels continue to increase in the future we would suggest implementing a more stringent monitoring program, including tributary sampling.

- Phosphorus concentrations remained low throughout the lake this year (Table 8). This indicates that the water quality is good in Little Lake Sunapee.

- *E. coli* originates in the intestines of warm-blooded animals (including humans) and is an indicator of associated and potentially harmful pathogens. Bacteria concentrations were very low at all the sites tested (Table 12). If residents are concerned about septic system impacts, testing when the water table is high or after rains is best. Please consult the Other Monitoring Parameters section of the report for the current standards for *E. coli* in surface waters.

NOTES

- Monitor's Note (6/11/00): Heavy rain preceding sampling. High tannin content (brown) in water. Visibility very poor.

- Biologist's Note (6/11/00): Chlorophyll samples were taken from the middle of each thermal layer; they are not composites.

USEFUL RESOURCES

Bacteria in Surface Waters, WD-BB-14, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

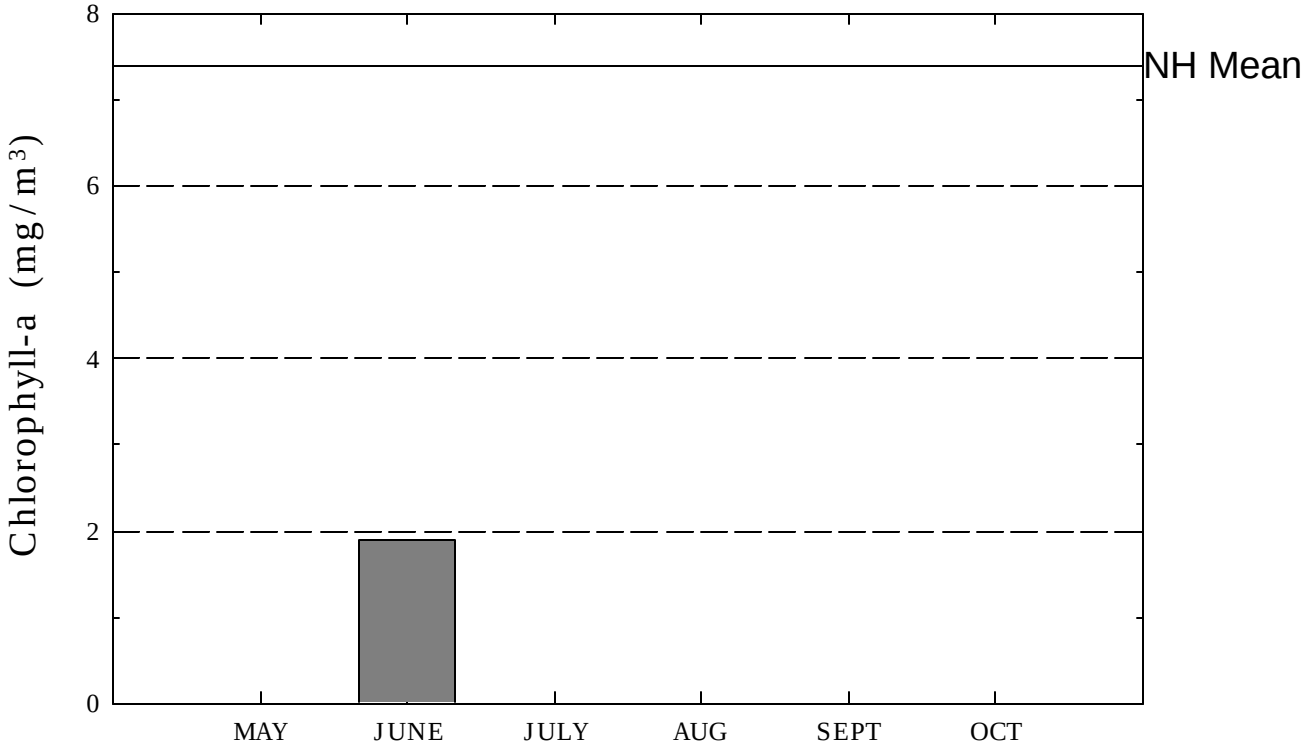
Septic Systems and Your Lake's Water Quality, WD-BB-11, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Effects of Phosphorus on New Hampshire's Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

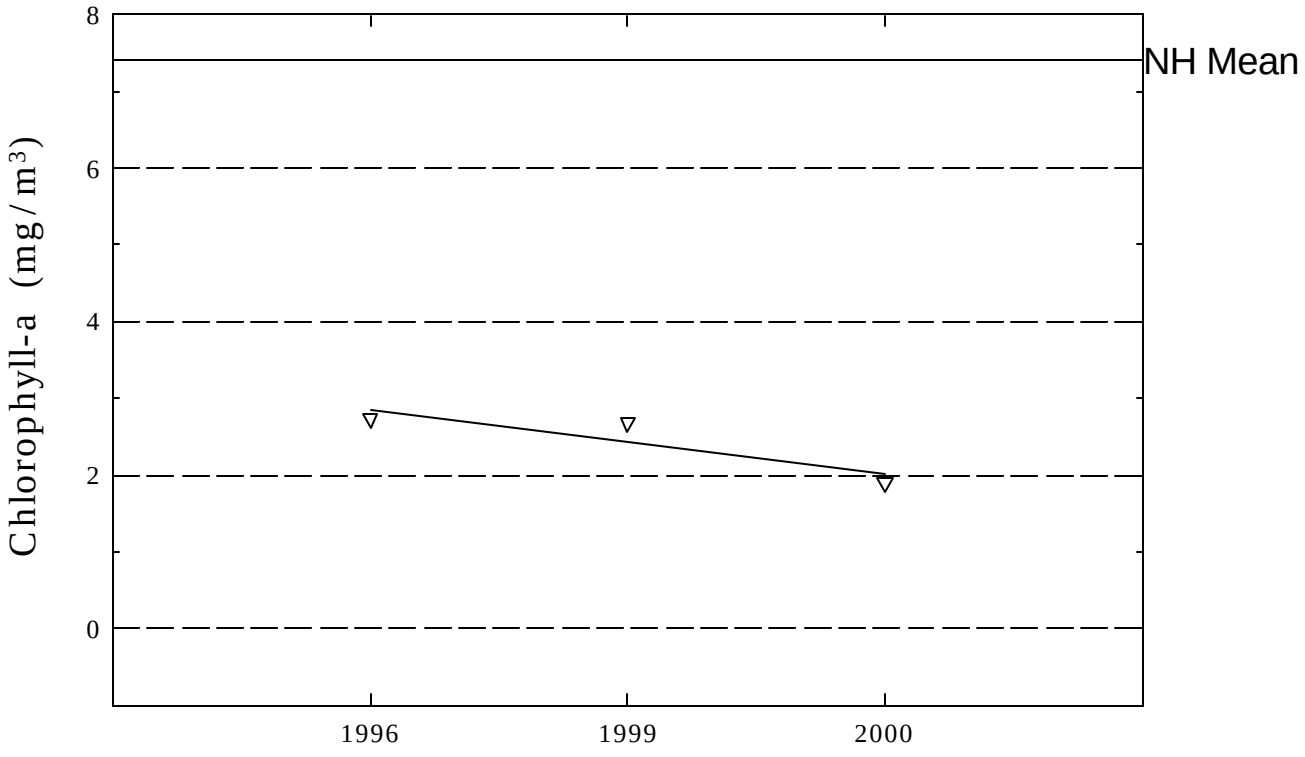
Native or Naturalized Shoreland Plantings for New Hampshire. NHDES Shoreland Protection Program. (603) 271-3503

Lake Sunapee, Little

Figure 1. Monthly and Historical Chlorophyll-a Results



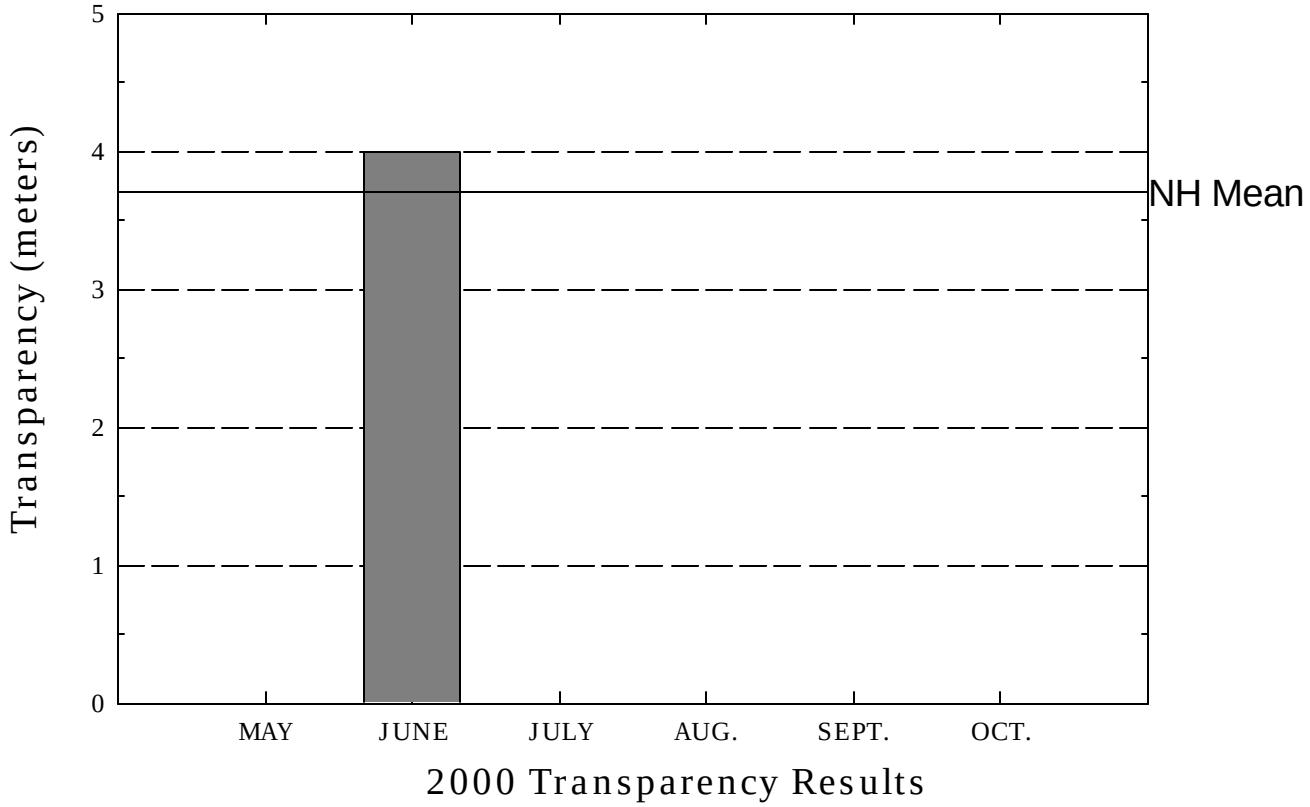
2000 Chlorophyll-a Results

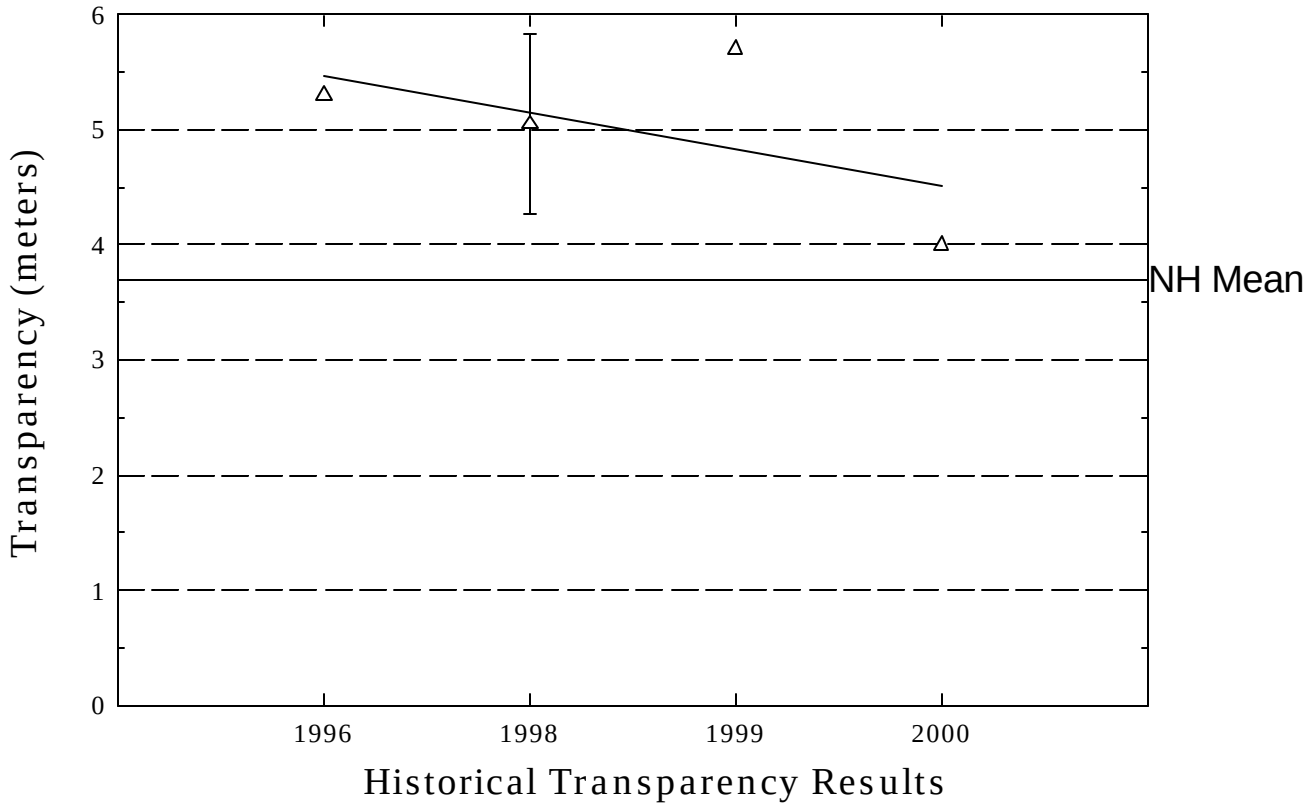


Historical Chlorophyll-a Results

Lake Sunapee, Little

Figure 2. Monthly and Historical Transparency Results





Lake Sunapee, Little

Figure 3. Monthly and Historical Total Phosphorus Data.

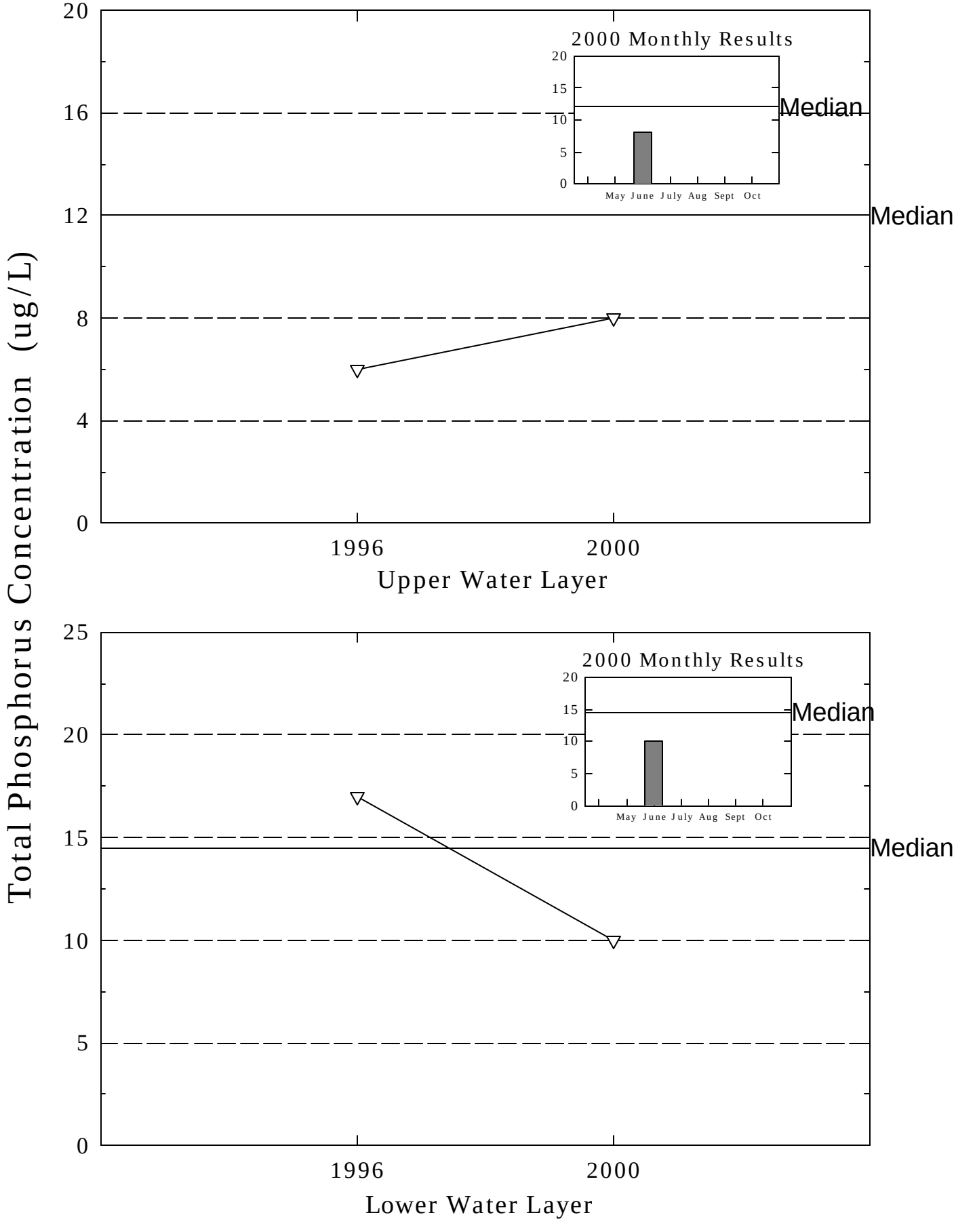


Table 1.

SUNAPEE LAKE, LITTLE

NEW LONDON

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1996	2.73	2.73	2.73
1999	2.68	2.68	2.68
2000	1.88	1.88	1.88

Table 3.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1996	5.3	5.3	5.3
1998	4.5	5.6	5.0
1999	5.7	5.7	5.7
2000	4.0	4.0	4.0

Table 4.

SUNAPEE LAKE, LITTLE

NEW LONDON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
A				
	1996	6.85	6.85	6.85
	1998	6.58	6.60	6.59
	1999	6.74	6.81	6.77
	2000	6.68	6.68	6.68
B-C				
	1998	6.68	6.68	6.68
	1999	6.89	6.89	6.89
B				
	1996	6.95	6.95	6.95
	1998	6.76	6.76	6.76
	1999	6.07	6.07	6.07
	2000	6.76	6.76	6.76
C				
	1996	6.96	6.96	6.96
	1998	6.83	6.83	6.83
	1999	6.15	6.15	6.15
	2000	6.77	6.77	6.77
D				
	1996	7.03	7.03	7.03
	1998	6.68	6.85	6.76
	1999	6.86	6.86	6.86
	2000	6.69	6.69	6.69

Table 4.

SUNAPEE LAKE, LITTLE

NEW LONDON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
E-F				
	1998	6.75	6.75	6.75
	1999	6.85	6.85	6.85
E				
	1996	6.96	6.96	6.96
	1998	6.77	6.77	6.77
	1999	6.76	6.76	6.76
	2000	6.75	6.75	6.75
EPILIMNION				
	1996	7.00	7.00	7.00
	2000	6.50	6.50	6.50
F				
	1996	7.00	7.00	7.00
	1998	6.79	6.79	6.79
	2000	6.77	6.77	6.77
G-H				
	1999	6.74	6.74	6.74
G				
	1998	6.79	6.79	6.79
H-G				
	1998	6.41	6.41	6.41

Table 4.

SUNAPEE LAKE, LITTLE

NEW LONDON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
H				
	1998	6.10	6.10	6.10
HYPOLIMNION				
	1996	6.50	6.50	6.50
	2000	6.21	6.21	6.21
I-J				
	1998	6.78	6.78	6.78
I				
	1998	6.14	6.14	6.14
	1999	6.87	6.87	6.87
K				
	1999	6.87	6.87	6.87
L				
	1998	6.76	6.76	6.76
	1999	6.76	6.76	6.76
METALIMNION				
	1996	6.20	6.20	6.20
	2000	6.61	6.61	6.61
O-2				
	1998	6.77	6.77	6.77
	1999	6.76	6.76	6.76

Table 4.

SUNAPEE LAKE, LITTLE

NEW LONDON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
O				
	1998	6.81	6.81	6.81
	1999	6.72	6.76	6.74
P				
	1998	6.87	6.87	6.87
	1999	6.87	6.87	6.87
Q				
	1998	6.75	6.75	6.75
	1999	6.85	6.87	6.86
S				
	1998	6.29	6.29	6.29
	1999	6.62	6.62	6.62
T				
	1999	6.86	6.86	6.86

Table 5.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1996	3.80	3.80	3.80

Table 6.

SUNAPEE LAKE, LITTLE
NEW LONDON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
A				
	1996	66.5	66.5	66.5
	1998	67.1	79.0	73.0
	1999	81.1	84.2	82.6
	2000	73.6	73.6	73.6
B-C				
	1998	67.1	67.1	67.1
	1999	82.1	82.1	82.1
B				
	1996	66.9	66.9	66.9
	1998	79.5	79.5	79.5
	1999	79.6	79.6	79.6
	2000	73.9	73.9	73.9
C				
	1996	66.8	66.8	66.8
	1998	80.2	80.2	80.2
	1999	86.7	86.7	86.7
	2000	73.7	73.7	73.7
D				
	1996	66.9	66.9	66.9
	1998	74.6	79.2	76.9
	1999	82.5	82.5	82.5
	2000	80.2	80.2	80.2
E-F				
	1998	74.5	74.5	74.5
	1999	88.9	88.9	88.9

Table 6.

SUNAPEE LAKE, LITTLE
NEW LONDON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
E				
	1996	61.6	61.6	61.6
	1998	71.1	71.1	71.1
	1999	90.3	90.3	90.3
	2000	81.7	81.7	81.7
EPILIMNION				
	1996	61.9	61.9	61.9
	2000	73.2	73.2	73.2
F				
	1996	61.5	61.5	61.5
	1998	70.9	70.9	70.9
	2000	81.6	81.6	81.6
G-H				
	1999	89.6	89.6	89.6
G				
	1998	71.0	71.0	71.0
H-G				
	1998	75.3	75.3	75.3
H				
	1998	73.5	73.5	73.5
HYPOLIMNION				
	1996	67.4	67.4	67.4
	2000	73.4	73.4	73.4

Table 6.

SUNAPEE LAKE, LITTLE
NEW LONDON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
I-J				
	1998	75.3	75.3	75.3
	1999	89.2	89.2	89.2
I				
	1998	76.9	76.9	76.9
	1999	90.5	90.5	90.5
K				
	1999	90.2	90.2	90.2
L				
	1998	75.7	75.7	75.7
	1999	89.3	89.3	89.3
METALIMNION				
	1996	61.7	61.7	61.7
	2000	72.9	72.9	72.9
O-2				
	1998	75.9	75.9	75.9
	1999	25.4	25.4	25.4
O				
	1998	75.6	75.6	75.6
	1999	25.9	91.9	58.9
P				
	1998	66.4	66.4	66.4
	1999	26.0	26.0	26.0

Table 6.

SUNAPEE LAKE, LITTLE
NEW LONDON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
Q				
	1998	64.5	64.5	64.5
	1999	25.4	84.7	55.0
S				
	1999	25.3	25.3	25.3
T				
	1999	85.0	85.0	85.0

Table 8.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
A				
	1996	6	6	6
	1998	4	17	10
	1999	5	5	5
	2000	4	4	4
B-C				
	1998	21	21	21
	1999	4	4	4
B				
	1996	6	6	6
	1998	4	4	4
	1999	4	4	4
	2000	5	5	5
C				
	1996	11	11	11
	1998	4	4	4
	1999	5	5	5
	2000	4	4	4
D				
	1996	6	6	6
	1998	5	17	11
	1999	5	5	5
	2000	4	4	4
E-F				
	1998	25	25	25
	1999	4	4	4

Table 8.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
E				
	1996	4	4	4
	1998	5	5	5
	1999	6	6	6
	2000	6	6	6
EPILIMNION				
	1996	6	6	6
	2000	8	8	8
F				
	1996	9	9	9
	1998	5	5	5
	2000	9	9	9
G-H				
	1999	6	6	6
G				
	1998	8	8	8
H-G				
	1998	10	10	10
H				
	1998	12	12	12
HYPOLIMNION				
	1996	17	17	17
	2000	10	10	10

Table 8.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
I-J				
	1998	25	25	25
	1999	6	6	6
I				
	1998	15	15	15
	1999	3	3	3
K				
	1999	5	5	5
L				
	1999	4	4	4
METALIMNION				
	1996	14	14	14
	2000	9	9	9
O-2				
	1999	4	4	4
O				
	1999	5	5	5
P				
	1998	14	14	14
	1999	5	5	5
Q				
	1999	4	6	5
S				
	1999	6	6	6

Table 8.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
T				
	1999	7	7	7

Table 11.

SUNAPEE LAKE, LITTLE
NEW LONDON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
A				
	1996	0.4	0.4	0.4
	1998	0.3	1.3	0.8
	1999	0.8	0.9	0.8
	2000	0.8	0.8	0.8
B-C				
	1998	1.1	1.1	1.1
	1999	0.7	0.7	0.7
B				
	1996	0.4	0.4	0.4
	1998	0.3	0.3	0.3
	1999	1.0	1.0	1.0
	2000	0.9	0.9	0.9
C				
	1996	0.4	0.4	0.4
	1998	0.3	0.3	0.3
	1999	3.1	3.1	3.1
	2000	0.8	0.8	0.8
D				
	1996	0.4	0.4	0.4
	1998	0.4	1.1	0.7
	1999	0.9	0.9	0.9
	2000	0.8	0.8	0.8
E-F				
	1998	1.2	1.2	1.2
	1999	0.8	0.8	0.8
E				

Table 11.

SUNAPEE LAKE, LITTLE
NEW LONDON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
E				
	1996	0.3	0.3	0.3
	1998	0.3	0.3	0.3
	1999	0.8	0.8	0.8
	2000	0.8	0.8	0.8
EPILIMNION				
	1996	0.4	0.4	0.4
	2000	0.9	0.9	0.9
F				
	1996	0.3	0.3	0.3
	1998	0.3	0.3	0.3
	2000	0.8	0.8	0.8
G-H				
	1999	0.9	0.9	0.9
G				
	1998	0.4	0.4	0.4
H-G				
	1998	1.0	1.0	1.0
H				
	1998	0.5	0.5	0.5
HYPOLIMNION				
	1996	3.6	3.6	3.6
	2000	1.0	1.0	1.0
I-J				
	1998	1.0	1.0	1.0
	1999	0.5	0.5	0.5

Table 11.

SUNAPEE LAKE, LITTLE
NEW LONDON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
I				
	1998	1.6	1.6	1.6
	1999	1.4	1.4	1.4
K				
	1999	0.6	0.6	0.6
L				
	1998	1.0	1.0	1.0
	1999	0.9	0.9	0.9
METALIMNION				
	1996	0.6	0.6	0.6
	2000	0.7	0.7	0.7
O-2				
	1998	1.0	1.0	1.0
	1999	0.8	0.8	0.8
O				
	1998	1.0	1.0	1.0
	1999	0.7	0.8	0.7
P				
	1998	1.1	1.1	1.1
	1999	0.8	0.8	0.8
Q				
	1998	1.1	1.1	1.1
	1999	0.7	0.8	0.7
S				
	1998	1.0	1.0	1.0
	1999	0.9	0.9	0.9

Table 11.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
T				
	1999	0.8	0.8	0.8

Table 12.

SUNAPEE LAKE, LITTLE

NEW LONDON

Summary of current year bacteria sampling.
Results in counts per 100ml.

Location	Date	E. Coli See Note Below
A		
	June 11	0
B		
	June 11	0
F		
	June 11	1

NOTE: "<" means "less than" and ">" means "greater than"